Controlling the Pore Size and Gelation Time of Resorcinol Formaldehyde Foam for Fabrication of Direct Drive Targets for ICF Experiments

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Resorcinol Formaldehyde (R/F) foam have been used in the fabrication of direct drive shell targets for Inertial Fusion Confinement (ICF) experiments at the University of Rochester's Laboratory for Laser Energetics (LLE). Recent cryogenic experiments at LLE using R/F shells have shown the necessity of larger pore foam compared to the standard R/F formulation. In this paper, we report on controlling the pore size of R/F foam with concomitant control of the gelation time, which is crucial for successful shell fabrication. The standard formulation was modified by decreasing the base catalyst to resorcinol concentration ratio to create large pore R/F through reaction limited aggregation. Large pore shells were successfully made. However, the decreased gelation time of this formulation decreased the yield of shell with proper wall uniformity (< 10 μm) to an unacceptable level of <1 %. We were able to achieve control over the gelation time, while keeping the large pore characteristics of R/F, by developing a new technique for large pore formation involving changes to the acid catalyst concentration. The effects of this new formulation on the wall uniformity of shells are discussed. Large pore R/F foams were characterized using a variety of techniques, including electron microscopy, nitrogen gas adsorption, visible spectroscopy, and small angle X-ray scattering.

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